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ABSTRACT

This paper describes three experiments related to differences in discrimination learning. In Experiment 1, sixth-grade subjects were required to judge the situational frequency of items which had occurred from 0 to 4 times on a study list. For one group the study list consisted of high-frequency words. Another group judged low-frequency words which were high in meaningfulness. A third group judged low-frequency words which were low in meaningfulness. A fourth group gave frequency judgments for nonsense items. Items were presented for study and test at a 5-second rate. The results supported the hypothesis that pre-experimental or background frequency differences in materials account for apparent frequency differences. In experiment 2, one group of sixth graders earned a 15-pair verbal discrimination list consisting of low-frequency/high-meaning words. Another group learned pairs of low-frequency/low-meaning words. A third group learned high-frequency words. No significant differences were found. In experiment 3, groups of beginning fourth graders learned high-frequency and low-frequency words presented on a word list. The results indicated that background frequency is negatively related to discrimination learning. (WR)

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Effects of Word Frequency and Word Knowledge on Children's Performance in Recognition and Discrimination Tasks[1,2]

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The notion which I shall attempt to elaborate in this paper is as follows: If (according to our hypothesis) background frequency is the crucial construct underlying picture-word differences in apparent frequency and, thus, in discrimination learning, then the finding should not be unique to picture-word comparisons. Rather, apparent frequency differences and concomitant differences in discrimination learning should be detected with any materials which differ in background frequency. We have conducted several experiments to test this notion, three of which I shall describe briefly.

Experiment I

In the first experiment we set out to compare high- and low-frequency words in an absolute frequency judgment task expecting that low-frequency words would produce frequency judgments resembling those obtained for pictures. That is, in comparison to high-frequency words, low-frequency words should produce higher judgments and have lower variability and greater accuracy associated with judgments. However, a review of the verbal discrimination learning studies in which high- and low-frequency words have been compared led us to qualify our predictions.

Some studies have found better performance with low-frequency than with high-frequency words (e.g., Underwood, Broder & Zimmerman, 1973); other studies have found little or no difference between the two (e.g., Paivio & Rowe, 1970). A study by Allen and Garton (1968) suggested to us a possible reason for this discrepancy. These authors found that recognition memory for low-frequency words is better when Ss know the meanings of the words than when

they do not--indicating that apparent frequency of low-frequency words may be influenced by Ss' semantic knowledge of the words. Therefore, we decided to control for "meaningfulness" of the materials (as we define it) when comparing low- and high-frequency words. Our expectation was that with meaningful low-frequency materials the above predictions concerning differences in frequency judgment performance between high- and low-frequency words would hold. With meaningless materials they might not.

Procedure. Sixth-grade Ss were required to judge the situational frequency of items which had occurred from 0 to 4 times on the study list. For one group (N per group = 20), the study list consisted of high-frequency words (from the AA and A range of the Thorndike & Lorge (1944) norms). Another group judged low-frequency words which were high in meaningfulness. A third group judged low-frequency words which were low in meaningfulness. The average frequency of the words in the latter groups was between 6 and 8 occurrences per million.

The meaningfulness of the low-frequency words was determined from pilot Ss who were given concrete nouns to both pronounce and define. Items which at least 80% of the Ss could both pronounce and define were classified as low-frequency/high-meaningful (Lo-F/Hi-M) words (e.g., "hatchet"). Items which at least 80% of the Ss could pronounce but no more that 20% could define were classified as low-frequency/low-meaningful (Lo-F/Lo-M) words (e.g., "dory"). A fourth group in the experiment gave frequency judgments for nonsense items which were included to assess the extreme of the meaningfulness dimension. The nonsense items were transformations of the Lo-F/Lo-M words which were expected to have even less meaning for Ss.

That is, even though the Lo-F/Lo-M words had little semantic content for Ss (as determined from the pilot ratings) their possible closer resemblance to known English words in terms of orthographic structure and pronunciability might afford more meaning and/or associations than would nonsense words. Accordingly we speculated that nonsense words would result in even lower mean frequency judgments, larger variability of judgments and lower accuracy (relative to high-frequency words) than would Lo-F/Lo-M words.

In all four conditions, Ss were run individually. Items were presented for study and test at a 5-second rate.

Results. The four conditions were contrasted on three response measures: Ss' mean judgments for items presented once during study; the variability of Ss' "one"-item judgments; and Ss' accuracy in identifying exactly the presentation frequency of all test items. As reflected in a composite measure of frequency judgment performance which was a linear combination of the above three measures, Lo-F/Hi-M words yielded judgments which were higher, less variable and more accurate than judgments produced for the high-frequency words. On the other hand the Lo-F/Lo-M words did not differ from the high-frequency words on the composite measure of frequency judgment performance. Finally, the nonsense words resulted in frequency judgment performance which was inferior to that produced by high-frequency words (i.e., nonsense words were characterized by lower mean judgments, higher variability and lower accuracy scores).

These results support the hypothesis that pre-experimental or background frequency differences in materials account for apparent frequency differences.

The results also indicate that predictions from Weber's Law as applied to the frequency judgment situation hold only for materials which have meaning for Ss. Extending these results to discrimination learning suggests that the elusive effect of word frequency in this task may be due to lack of control of the meaningfulness variable. To test this notion an experiment was carried out utilizing the previously described materials in a verbal discrimination learning task.

Experiment II

Procedure. Three groups of sixth-grade children participated (N per group = 16). One group learned a 15 pair verbal discrimination list consisting of the Lo-F/Hi-M words. Another group learned pairs comprised of the Lo-F/Lo-M words. The third group learned a list consisting of the high-frequency words. One silent (no guess) anticipation study trial was given followed by four anticipation response trials. The pairs were presented at a 5-second rate and E pronounced both words of each pair on the anticipation phase of each trial.

Results. In terms of the total number of pairs correctly discriminated the Lo-F/Lo-M group was significantly inferior to the high-frequency word group. While the mean number correct on the Lo-F/Hi-M word list was higher than for the high-frequency list, the difference was not significant.

In order to gain some understanding of this latter result which was contrary to prediction, an analysis of verbal discrimination performance as a function of Ss' knowledge of the meanings of the Lo-F/Hi-M words was

carried out. To do this, Ss in all three groups were given a definitions test on the 30 Lo-F/Hi-M words contained in the verbal discrimination list. On the test, E pronounced all of the words and, after hearing each word, S was required to define it. Performance on the definitions test indicated substantial variation among Ss in their knowledge of the meanings of the words. The 48 Ss were divided into two approximately equal-sized groups based on their definitions test score--a high group who defined 27 or more words out of 30 and a low group who scored between 17 and 26 correct out of 30. Only for the Ss in the Lo-F/Hi-M condition was there an effect of knowing the definitions on discrimination performance. For Lo-F/Hi-M Ss the mean number correct in verbal discrimination for the high group on the definitions test was 53.22; for the low group the mean was 45.00. In the high-frequency condition the mean correct in verbal discrimination was 47.75 for the high group and 47.12 for the low group. The corresponding verbal discrimination mean scores for the Lo-F/Lo-M condition were 40.33 for the high group and 41.90 for the low group. Looked at another way, for those Ss who scored high on the definitions test, a nested comparison revealed that Lo-F/Hi-M Ss (with a mean of 53.22 correct in verbal discrimination) were significantly superior to high-frequency Ss (with a mean of 47.75). However, for those who scored low on the definitions test no significant difference between high-frequency Ss (M = 47.12) and Lo-F/Hi-M Ss (M = 45.00) was observed.

This latter analysis suggests that there is a negative relationship between word frequency and discrimination performance when Ss know the meanings of the low-frequency words they are attempting to discriminate. However, the

data from this experiment were less than satisfying because complete control over meaningfulness was not obtained. Consequently, another experiment was carried out with new high- and low-frequency materials such that meaningfulness was controlled at a uniformly high level.

Experiment III

Procedure. Fifty-two concrete nouns were selected with half designated as high frequency and half as low frequency as determined from Carroll, Davies, and Richman's (1971) word-frequency norms for the third-grade level. By selecting from actual materials used by children, we sought to obtain more realistically based high- and low-frequency words than those determined from more remote norms such as those of Thorndike and Lorge (1944). In particular, the Carroll et al. norms are derived from samples of children's reading materials, grade level by grade level. Overall, the low-frequency words (with a mean of 7.5 occurrences in third-grade materials) appeared in such samples much less frequently than the high-frequency words (with a mean of 351.5 occurrences). An attempt was made to match the high- and low-frequency words with respect to their general object class (e.g., "dog" with "ape"; "window" with chimney"). The final selection of words resulted from initial pilotings with a larger sample of materials. Items were selected such that: (a) High- and low-frequency words which were generated from the Carroll et al. norms were also so designated by pilot Ss; and (b) All high- and low-frequency words were uniformly meaningful to pilot Ss.

Two 13 pair discrimination lists were constructed--one of high-frequency words and the other of low-frequency words. Independent groups of beginning fourth-grade children learned the lists and were given one anticipation study trial followed by two response trials. A 3-second presentation rate was used with E pronouncing each word in the pairs on the anticipation phase of each trial.

Results. The mean number correct over two trials for the high-frequency list was 18.28; that for the low-frequency list was 20.94. The effect of frequency was significant in the predicted direction which substantiates our hypothesis that background frequency is negatively related to discrimination learning.

In summary, the three experiments just described indicate that background frequency influences the apparent frequency and discrimination learning of verbal materials in a manner prescribed by Weber's Law. The results are in accord with the general theoretical framework presented earlier in this session. In addition, the experiments have shown that the negative relationship between background frequency and apparent frequency and, in turn, between background frequency and discrimination learning is evident only for verbal materials which are meaningful to Ss. It is not unlikely that the equivocal nature of the evidence concerning effects of word frequency in discrimination learning is due, at least in part, to confounding of meaningfulness (as defined here) and frequency.

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